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Trudel et al.

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[54] **CIRCUIT BREAKER LINE AND LOAD TERMINAL**

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[73] Assignee: **General Electric Company**, New York, N.Y.

[21] Appl. No.: **667,778**

[22] Filed: **Jun. 21, 1996**

[51] **Int. Cl.**[6] **H01R 4/50**

[52] **U.S. Cl.** **439/864**

[58] **Field of Search** 439/864, 790

[56] **References Cited**

U.S. PATENT DOCUMENTS

1,946,897	2/1934	Carlson	200/134
2,482,966	9/1949	Cook	439/864
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3,354,518	11/1967	Hoover	439/864
3,845,457	10/1974	Riemer	439/864
4,513,268	4/1985	Seymour et al.	335/35
4,759,726	7/1988	Naylor et al.	439/441
4,966,563	10/1990	Pierce et al.	439/729

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85256	5/1965	France	439/864
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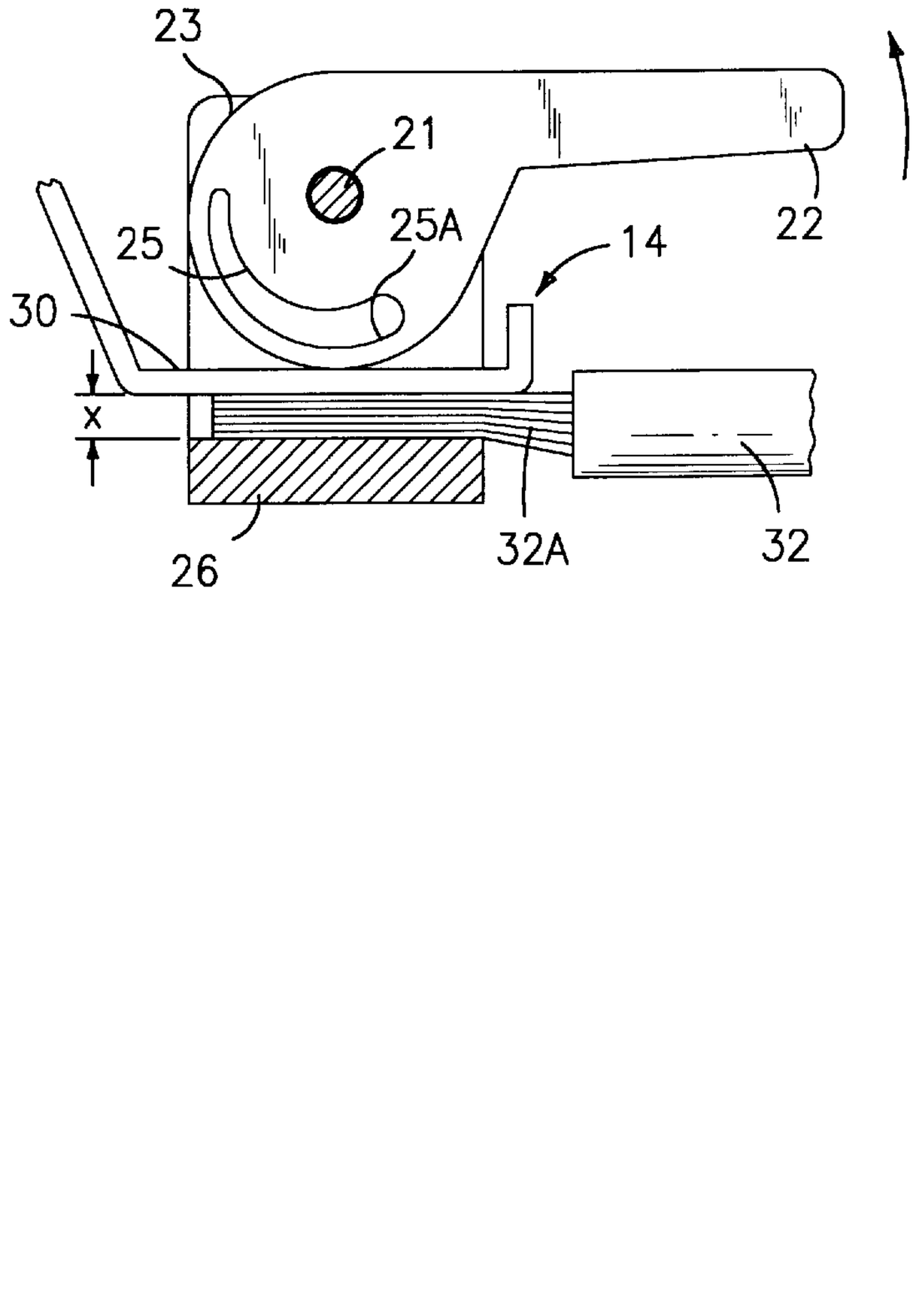
Attorney, Agent, or Firm—Richard A. Menelly; Carl B. Horton

[57] **ABSTRACT**

A spring-loaded cam electrical connector is used to rapidly connect circuit breaker load terminal straps with the associated electric distribution system wire conductors. Rotation of the cam in one direction traps the end of the wire conductor between the bottom of the cam support and the circuit breaker load terminal strap to make the electrical connection while rotation of the cam in the opposite direction releases the end of the wire conductor to break the electrical connection.

6 Claims, 3 Drawing Sheets



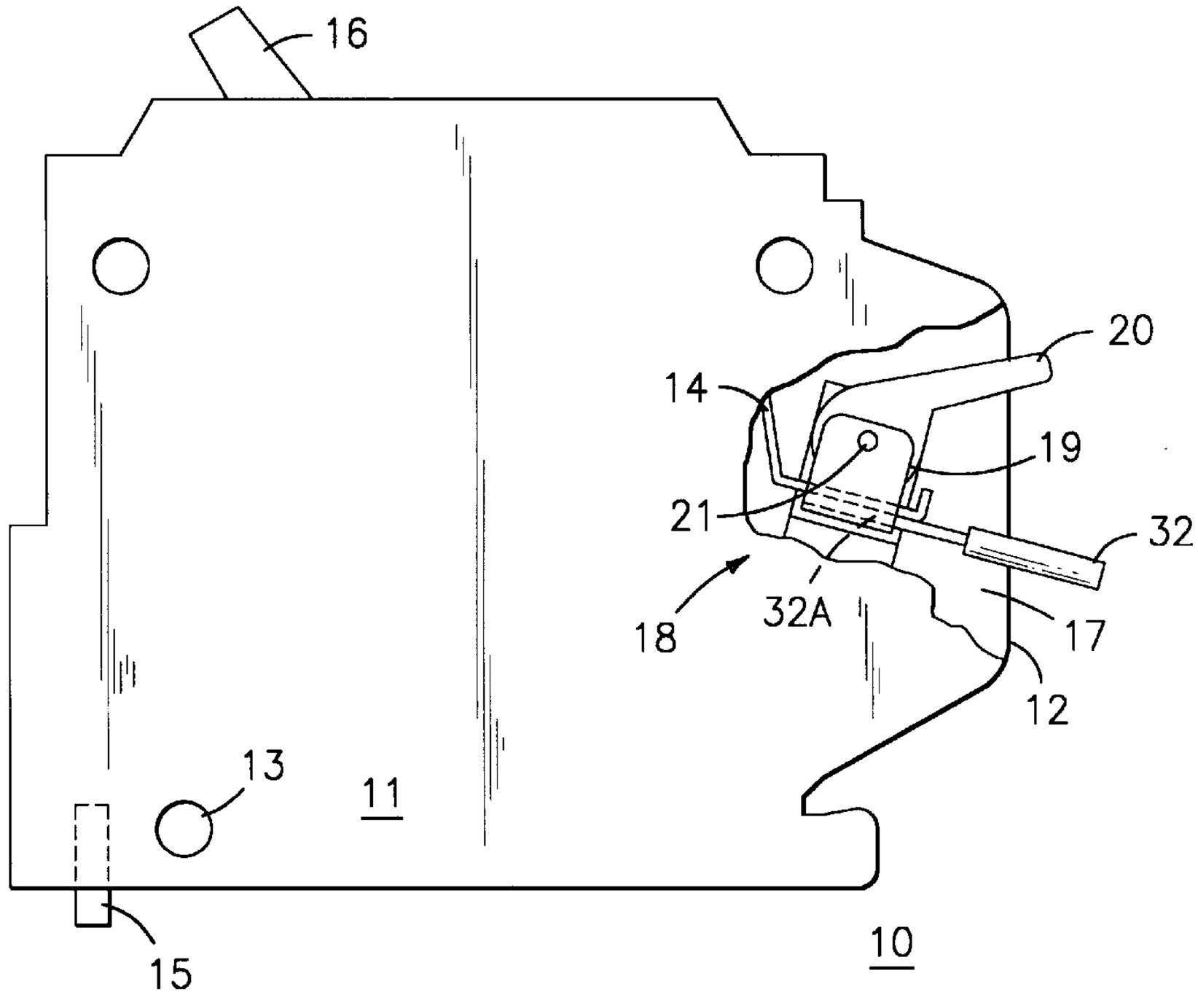

16
20
14
19
21
32
32A
18
17
12
13
11
15
10

FIG. 1

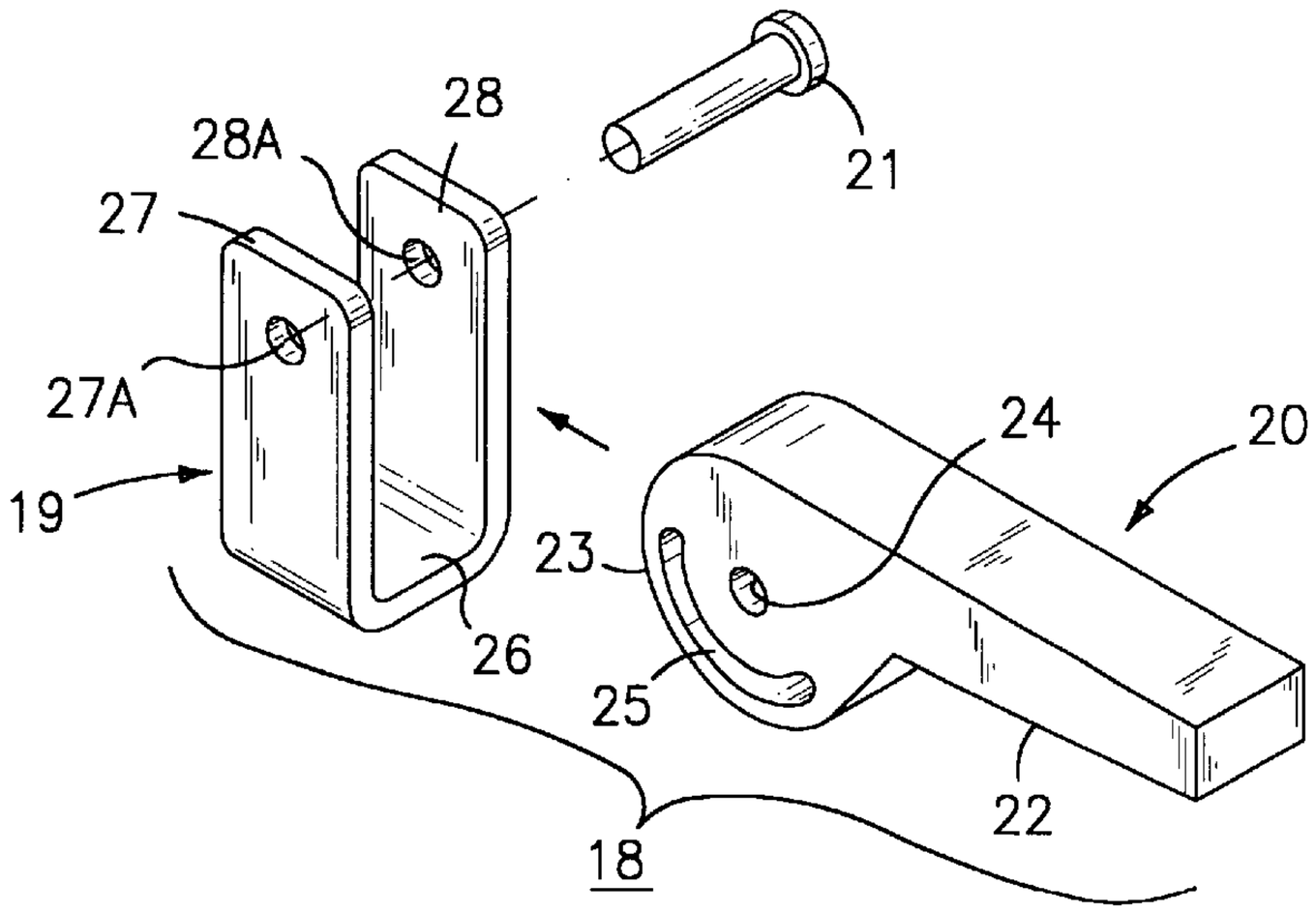

28
28A
27
21
27A
19
24
20
23
26
25
22
18

FIG. 2

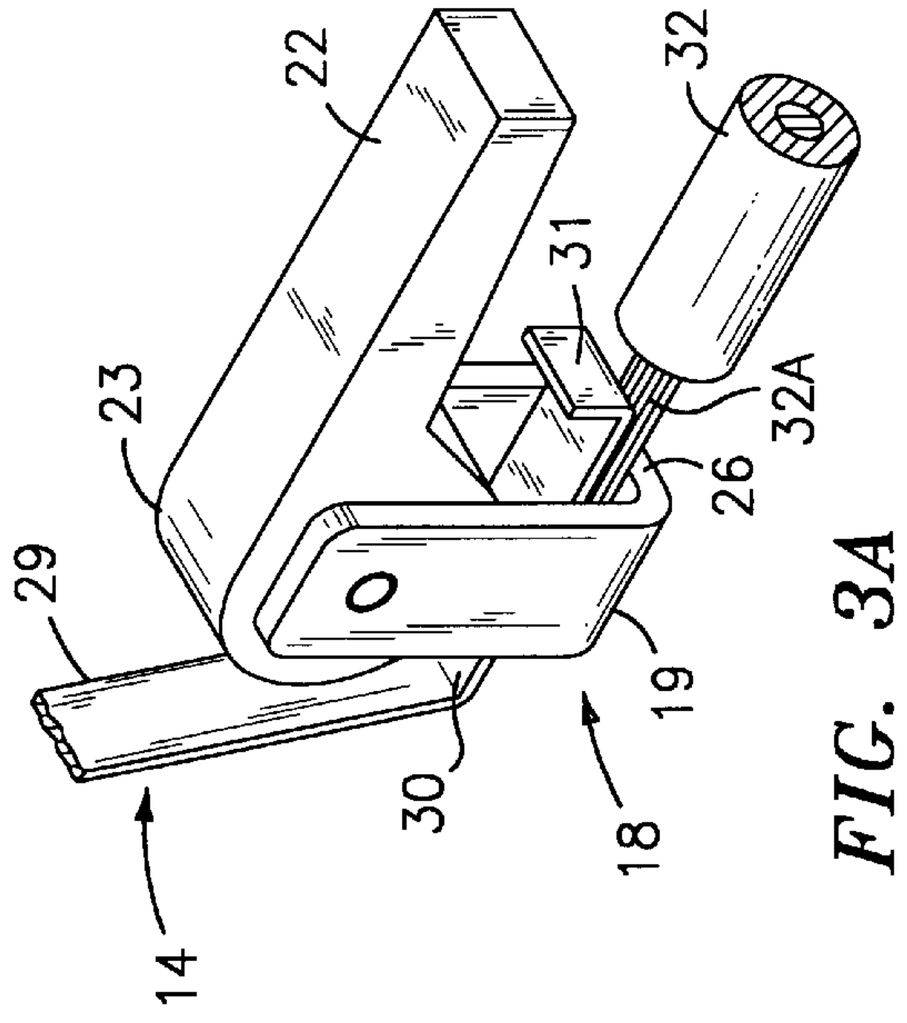


FIG. 3A

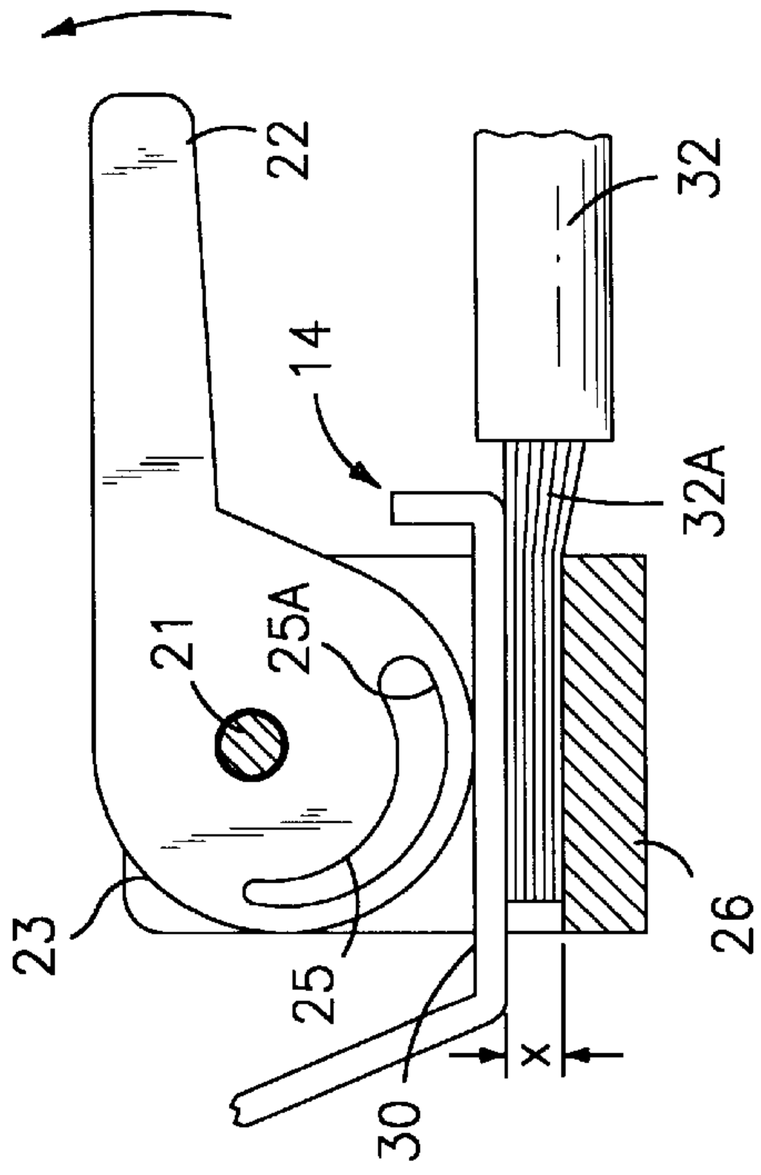


FIG. 3B

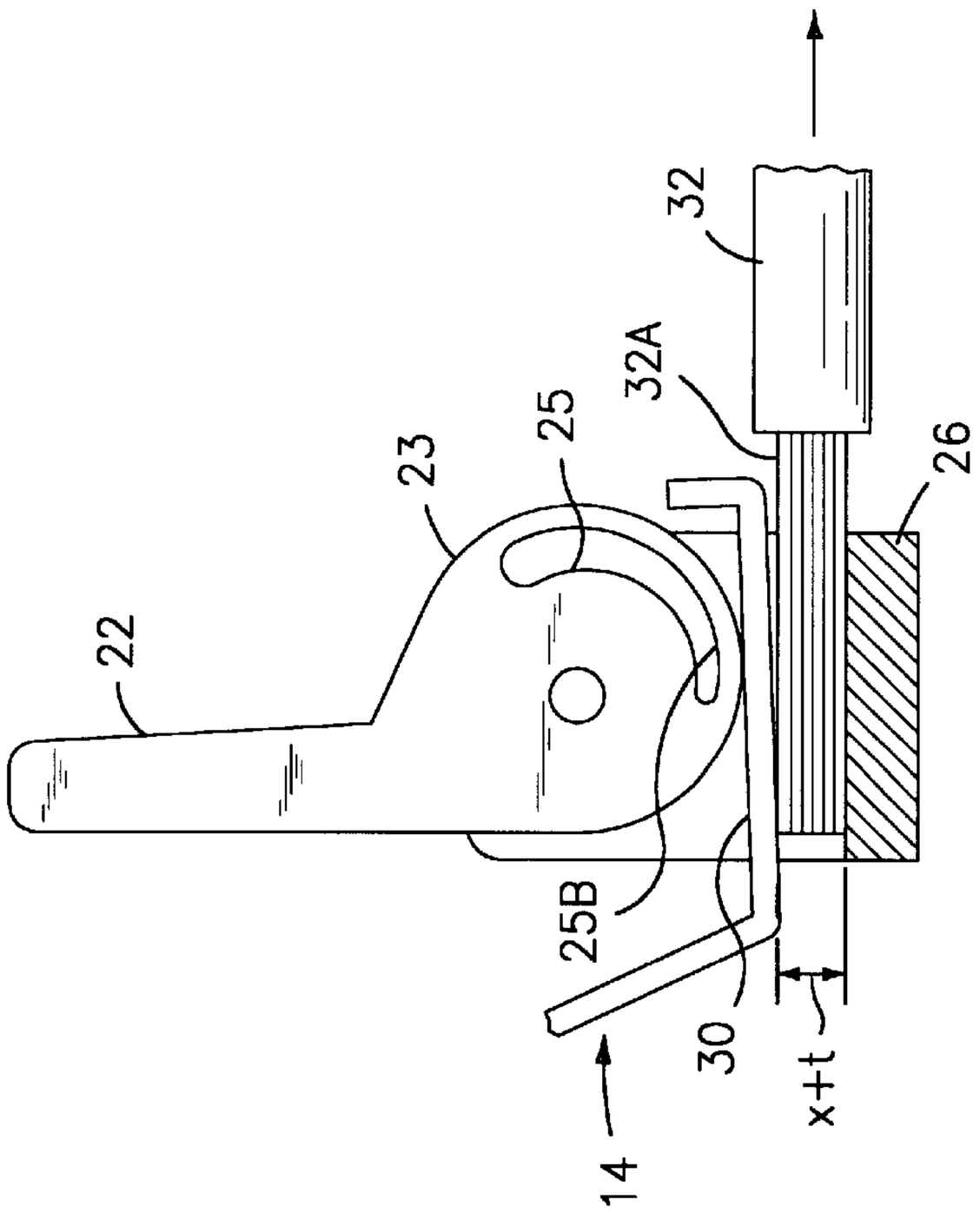


FIG. 3C

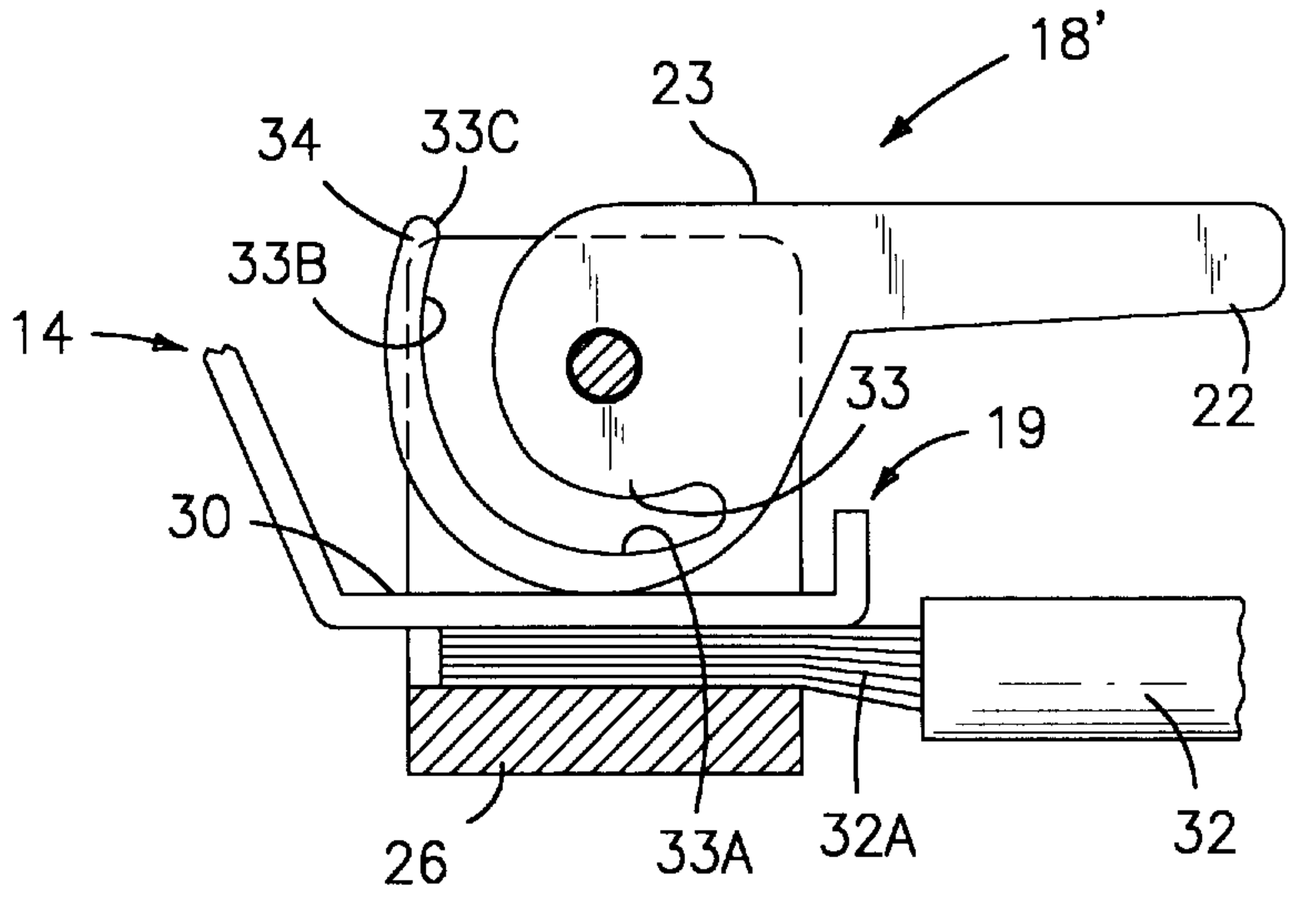

18'
23
34
33C
33B
14
33
19
22
30
26
33A
32A
32

FIG. 4A

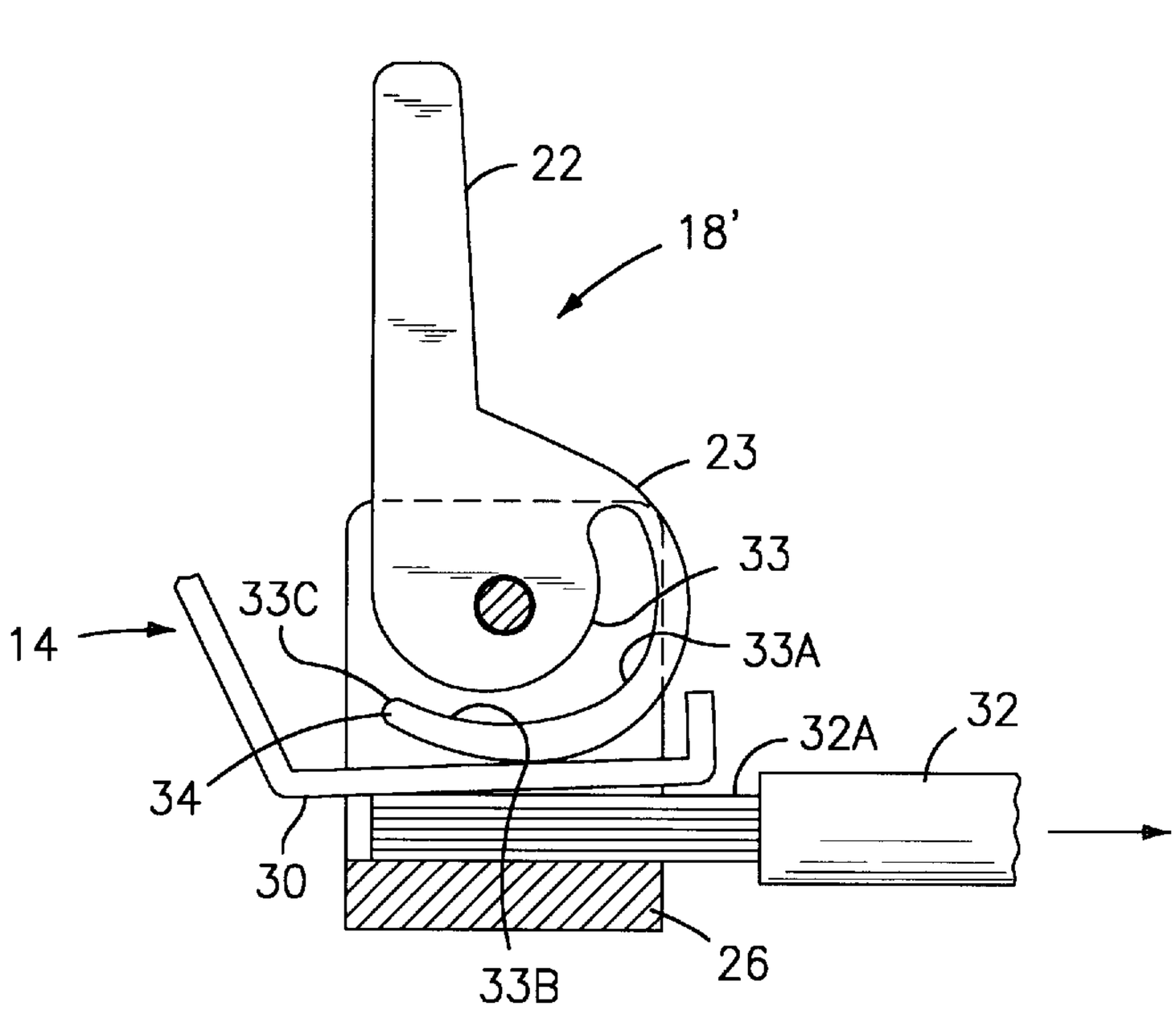

22
18'
23
33
14
33C
33A
32A
32
34
30
26
33B

FIG. 4B

CIRCUIT BREAKER LINE AND LOAD TERMINAL

BACKGROUND OF THE INVENTION

Residential circuit breakers such as described within U.S. Pat. No. 4,513,268 entitled "Automated Q-Line Circuit Breaker" are arranged within a load center in residences, apartment buildings and the like. The line straps at one end of the circuit breakers are positioned on the corresponding line stabs within the load centers and the load straps at the opposite end are arranged within load lugs which are manually connected with corresponding electrical distribution conductors by means of load terminal screws.

Upon initial installation of the load center, substantial time is required to manually torque each of the load terminal screws to insure tight mechanical and electrical connection between the circuit breaker load straps and the associated wire conductors.

U.S. Pat. Nos. 1,946,897 entitled "Electric Fuse Clamp", 2,864,071 entitled "Clamping Device for Electric Wires", 4,759,726 entitled "Screwless Type Electrical Terminal Block" and 4,966,563 entitled "Bus Bar Tab Connector" describe various means for attaching circuit breakers, fuses and the like to associated wire conductors. Each of the devices within the aforementioned patents require sizing the connectors in accordance with the size of the associated wire conductors. The camming arrangement disclosed in aforementioned U.S. Pat. No. 4,759,726, for example, is sized for use with printed circuit board terminals which operate at much lower currents than residential circuit breakers.

U.S. patent application Ser. No. 08/667,777 entitled "Circuit Breaker Load Strap Connector", filed Jun. 21, 1996, describes a rapid lug connector that utilizes a charged compression spring to provide torqued connection between the circuit breaker load strap and the associated wire conductor.

One purpose of the invention is to provide a circuit breaker load strap connector that is capable of handling current levels associated with residential and industrial electrical distribution circuits and can be rapidly connected with the associated wire conductors without requiring screwdrivers or similar tools to make the connection.

SUMMARY OF THE INVENTION

A spring-loaded steel or plastic cam electrical connector is used to rapidly connect circuit breaker load terminal straps with the associated electric distribution system wire conductors. The cam is configured to incorporate a tear-shaped slot having a wide end and a narrow end. Rotation of the cam in one direction traps the end of the wire conductor in contact with the circuit breaker load terminal strap by compression of the wide end of the slot against the load terminal strap. Rotation of the cam in the opposite direction positions the narrow end of the slot against the terminal strap and allows release of the end from the end of the wire conductor from the circuit breaker terminal strap connection.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of a circuit breaker embodying the spring-loaded cam connector according to the invention;

FIG. **2** is an enlarged top perspective view of the cam connector of FIG. **1** prior to assembly;

FIG. **3**A is a top perspective view of the cam connector of FIG. **2** connecting a wire conductor to the circuit breaker load strap;

FIG. **3**B is a side view in partial section of the cam connector of FIG. **3**A with a part of the cam support removed to depict the spring slot in compression;

FIG. **3**C is a side view in partial section of the cam connector of FIG. **3**A with the spring slot out of compression;

FIG. **4**A is an enlarged side view of an alternate embodiment of the cam connector of FIG. **1** with the spring slot out of compression; and

FIG. **4**B is a side view of the cam connector of FIG. **4**A with the spring slot in compression.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The circuit breaker **10** shown in FIG. **1** is similar to the one described within the aforementioned U.S. Pat. No. 4,513,268 and consists of an electrically-insulative top cover **11** that is attached to an electrically-insulative base **12** by means of corresponding rivets **13**. Electrical connection between the load strap **14** and the line terminal connector **15** is controlled by the operating handle **16**. In accordance with the invention, a terminal connector **18** is arranged within the load terminal compartment **17** for connecting with the end **32**A of the wire conductor **32** which, in turn, connects with the associated electrical distribution system. The terminal connector **18** includes a cam operator **20** mounted within a U-shaped cam support **19** by means of the pivot pin **21**.

The cam operator **20** is shown in the terminal connector **18** depicted in FIG. **2** to consist of an integrally-formed handle **22** extending from a cam **23**. The thru-hole **24** extending through the cam receives the pivot pin **21** to pivotally mount the cam operator within the U-shaped support **19** by means of corresponding apertures **27**A, **28**A within the side arms **27**, **28** respectively. The side arms are joined together by means of the base **26**. An important feature of the invention is the provision of a tear-shaped elongated slot **25** formed in the cam **23** which behaves as a compression spring when the terminal connector is used to connect with the associated wire conductor **32** as shown in FIGS. **3**A–**3**C.

The cam is formed from a metal composition having a high coefficient of elasticity that allows the tear-shaped slot **25** to have spring-like properties. In FIG. **3**A, the terminal connector **18** is arranged on the front planar extension **30** of the circuit breaker load strap **14**. The load strap is similar to that described in aforementioned U.S. Pat. No. 4,513,268 and includes a back part **29** connecting with the circuit breaker current-carrying components (not shown) and a front lip **31**. The terminal connector **18** is positioned over the planar extension **30** of the load strap **14** such that the cam **23** contacts the extension and drives the extension against the end **32**A of the wire conductor **32** and traps the end of the wire conductor against the base **26** of the cam support **19** when the handle **22** is rotated. In the connected position also depicted in FIG. **3**B, the wide end **25**A of the slot **25** is positioned against the front part **30** of the load strap **14** such that the force transferred from the handle through the cam **23** is transferred via the compression of the wide end **25**A of the slot **25** against the front part **30** thereby compressing the end **32**A of the wire conductor **32** tightly against the base **26** as indicated by the thickness x of the end **32**A under compression. The force generated by compression of the wide end **25**A is directed through the center of the pivot pin **21** which prevents the cam **23** from rotating until the handle **22** is again rotated in the counter-clockwise direction. When the handle **22** is next rotated in the counter-clockwise direction,

as indicated in FIG. **3**C, the cam **23** rotates such that the narrow end **25**B abuts the front part **30** and the end **32**A of the wire conductor **32** assume the thickness x+t which readily allows the end **32**A to become released from between the front part **30** of the load strap **14** from the base **26** when a translatory force is applied to the wire conductor **32** in the indicated direction.

The terminal connectors **18'** shown in FIGS. **4**A and **4**B compensate for variations in the thickness of the end **32**A of the conductor **32** after the end is removed from between the front part **30** of the load terminal strap **14** and the base **26** of the support **19**. The cam **23** has a similar tear-shaped slot **33** with a wide end **33**A for compressing the end **32**A between the front part and the base as shown in FIG. **4**A. The slot **33** differs from that shown earlier by inclusion of a gap **33**C formed in the edge of the narrow end **33**B. This allows the bottom **34** of the cam **23** to become spring-loaded in the direction of the base **26**. When the end **32**A of the conductor **32** is next inserted within the terminal connector **18'0** with the handle **22** in the position depicted in FIG. **4**B, the bottom **34** of the cam **23** forces the front part **30** of the load terminal strap **14** against the end **32**A of the conductor **32** into compression between the front part and the base to compensate for the reduced diameter of the end of the conductor. With the narrow end **33**B over the front part of the load terminal, the spring-loaded bottom **34** of the cam compensates for the reduced diameter and automatically allows for tolerance variations between different size initial wire conductor diameters as well as the differences caused by removal and re-insertion.

A simple and economical terminal connector has herein been described which allows rapid connection and disconnection between a circuit breaker load strap and associated wire conductors without requiring use of a tool during the connection and disconnection process.

We claim:

1. A circuit breaker having facility for rapid connection with and disconnection from an electrical wire conductor comprising:

an electrically-insulative cover connected with an electrically-insulative plate;

a first terminal connector at one end of said cover and plate for connection with an electrical distribution system;

a second terminal connector at an opposite end of said cover and plate for connection with said electrical distribution system;

an operating handle extending from said cover and said plate and arranged for electrical connection and disconnection between said first and second terminal connectors;

a wire connector associated with said second terminal connector, said wire connector comprising:

a U-shaped support having a pair of side arms upstanding from a support base;

a cam pivotally arranged intermediate said side arms, said cam including a slot formed in said cam, said slot defines a first end and a second end, said first end being wider than said second end allowing said cam to provide various compressive force against said wire terminal and said wire conductor; and

an operating handle at one end of said cam for rotating said cam against a wire terminal, whereby said cam traps a wire conductor between a bottom of said wire terminal and said base for mechanical and electrical connection between said wire conductor and said wire terminal.

2. The circuit breaker of claim **1** wherein said first end of said slot is oriented toward a first end of said wire terminal.

3. The circuit breaker of claim **1** wherein said cam comprises plastic.

4. The circuit breaker of claim **1** wherein said cam comprises metal.

5. The circuit breaker of claim **1** wherein said slot defines a tear-shaped configuration.

6. The circuit breaker of claim **1** wherein said wire terminal comprises a circuit breaker terminal strap.

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